

**PHYTOTOXICOLOGY SECTION
VERIFICATION SAMPLING
OF THE SOUTH RIVERDALE
SOIL REPLACEMENT PROJECT**

MARCH 1993

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**PHYTOTOXICOLOGY SECTION VERIFICATION SAMPLING
OF THE SOUTH RIVERDALE SOIL REPLACEMENT PROJECT**

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1 Executive Summary

The South Riverdale neighbourhood, north of the Canada Metal Company plant, was subject to the removal of lead-contaminated soil to a depth of 30 centimetres and replacement with uncontaminated soil and sod. Gravel from areas used for vehicle parking was replaced to a depth of 15 centimetres. The replacement took place on sites comprising residential and school properties and municipal road allowances. To qualify for replacement, a site had to be located on a property occurring within a zone designated by the Toronto Department of Public Health, the soil lead concentration in the top five centimetres had to be 500 ppm or higher, and the property owner had to grant permission for the replacement.

Near the completion of the project, the Phytotoxicology Section conducted a verification study to assess the success of the project. Eighty-nine, or approximately ten percent, of the qualifying sites were randomly selected for verification sampling. By the date of the verification sampling (October, 1988), most of the replacement activities had been completed.

The results of the study revealed that all selected sites had very low soil lead concentrations in the top five centimetres. At most sites, these low concentrations extended to a 25 centimetre depth. However, at 13 sites the soil lead concentrations in the 0 to 25 cm increment were significantly higher than what was reported to be the concentration in the replacement soil.

Due to uncertainties arising from technical difficulties in sampling of uncompacted soil, it was decided to conduct more detailed sampling at these sites. This subsequent sampling, conducted in May, 1991, confirmed that the initial sampling procedures penetrated into the underlying indigenous soil at some sites. At a limited number of sites, the soil at a depth of 15 to 25 centimetres had elevated lead. This observation demonstrates the necessity of replacing the top 30 centimetres of soil to ensure that the top 15 centimetre increment was free of excess lead.

This subsequent sampling also indicated increased lead concentrations in the top five centimetres of replacement soil.

Sampling of car parking areas, which were replaced with coarse gravel, generated unavoidably biased samples of fine material from the gravel matrix. This material had unexpectedly high concentrations of lead.

2 Introduction

Studies conducted by the Ontario Ministry of the Environment in the early 1970's indicated that the neighbourhood north of Canada Metal Company Limited (CMC), a secondary lead refinery at 721 Eastern Avenue in Toronto, contained soil that was contaminated by lead (Temple et al. 1975). Long-term emissions from the refinery, along with vehicular traffic, were identified as sources of this contamination.

There was concern regarding resident children ingesting soil with elevated lead concentrations during their play activities. Also, residents were concerned about eating produce that had been grown in the contaminated soil.

In 1976, following a detailed hearing, the Environmental Hearing Board recommended that sites with 3000 parts per million (ppm) or more of lead in the soil should have the soil removed and replaced with uncontaminated soil. Due to inherent errors in sampling and analysis, this recommended replacement criterion was lowered to 2600 ppm. In 1977, 28 sites on 19 residential properties were subject to the removal of the top fifteen centimetres of soil. This was replaced with soil that contained approximately 7 ppm of lead. An inadequate replacement depth and mixing with contaminated subsoil resulted in higher than desirable concentrations of lead at these replaced sites. (McLaughlin, 1978)

In 1983, the Toronto Department of Public Health concluded that soil containing 1000 ppm or more of lead posed a health risk to young children. The Phytotoxicology Section of the Ministry of the Environment conducted an extensive soil sampling program in 1985 to delineate the area of the neighbourhood that contained soil with greater than 1000 ppm lead.

The 1985 sampling program was based on a computer-generated 1000 ppm isopleth line using data available up to that time. Residential properties within and slightly beyond this line were targeted for comprehensive sampling. This included sampling of all distinct areas on any given property with a soil surface (eg., front, back and side yards). While 407 properties fell within this target, only 389 had some part sampled. The remaining properties either did not have suitable sampling areas, or the owner declined permission for the sampling. The total number of sites sampled was 716, on 389 properties.

In December, 1986, the Lead in Soil Committee was organized by the Ministry of the Environment to recommend scientifically defensible replacement criteria for soil contaminated by lead. The Committee recommended that soil with a lead concentration of between 500 and 1000 ppm or more be replaced. The Committee further recommended that the replacement be to a depth of 30 centimetres since the experience with 15 centimetre replacement project of 1977 demonstrated mixing with indigenous, contaminated soil as a result of inadequate replacement depth. Since the primary concern was the health of children who might ingest soil, the replacement guideline would depend on whether children had access to a site (MOE, 1987).

3 Soil Replacement Area and Procedures

Based on the 1985 soil sampling, a soil replacement zone was delineated by the Toronto Board of Health. The zone boundary extended beyond the 1000 ppm isopleth line generated from the pre-1985 soil lead data and followed road and street lines or other logical geographic features. On November 19, 1986, the Minister of the Environment announced that a soil replacement program, within this designated zone, for those properties with soil lead above 500 ppm, would commence as soon as possible.

In 1987, the consulting firm, The Proctor and Redfern Group, was retained to conduct soil sampling on all residential properties within the designated zone that had not been sampled by the Phytotoxicology Section in 1985. This newest data, together with the 1985 data, would be used to determine those properties and sites on properties that contained soil with 500 ppm or more lead. A total of 939 properties were identified for replacement of soil on at least one site.

The replacement zone was divided into four contract areas plus an initial demonstration area. Separate contracts with construction companies were awarded for these five areas.

The replacement began in September, 1987. Soil on all qualifying residential and school property sites was replaced by the end of 1988. Municipal road allowance sites were replaced in 1989 under a sixth contract (not subject to the verification sampling reported on in this document). Commercial and industrial properties were excluded from this project.

The specifications for replacement activities required that the top 30 centimeters of soil from lawn and bedding areas be removed. Under certain conditions, removal of soil was to be less than 30 centimetres. These exceptions included areas around trees and shrubs where roots were not to be undermined. Soil in areas around posts, sidewalks, and house foundations with termite barriers was to be removed to lesser depths to avoid disturbing these structures.

New soil was to be placed in two layers (lifts). The first layer was to be 20 centimeters. After levelling, a second layer of 15 centimeters, for a total of 35 centimetres, was to be placed, leveled and sodded. The excess depth was to compensate for settling. No compaction was to be performed apart from that which would occur during the levelling and sodding activities.

The 30 centimetre excavation depth as well as the two-lift replacement procedure were designed to ensure that surface soil, specifically the top 15 centimetres, would be free of excess lead and not be subject to re-contamination by underlying soil which occurred after the 1977 soil replacement program.

Gravel areas, specifically those used for vehicle parking, were to be excavated to a depth of 15 centimeters and replaced with crushed stone (16 mm) to a depth of 15 centimetres after mechanical compaction.

The topsoil for the replacement project was obtained from rural areas undergoing development for housing or industry. Two sources of replacement soil were used. This soil was delivered from the source areas and stockpiled closer to the South Riverdale area. Samples of this topsoil were analyzed for lead, as well as other elements, before it was removed from the rural field. The lead concentrations from one source ranged from <5 to 50 ppm, and from <5 to 19 ppm from the other source. Sod was obtained from four different sod farms. This sod was also analyzed and reported to contain <28 ppm in all four cases (Proctor and Redfern, 1989).

The gravel for replacement of parking areas was obtained from a quarry. Analysis was not performed because this was considered a natural, geologic material (Boyd, 1989).

4 Phytotoxicology Section Verification Survey

4.1 Background and Purpose

In October, 1988, as the replacement program was nearing completion, the Phytotoxicology Section conducted an independent survey to assess the replacement activities. This survey was to determine if the soil or gravel at designated sites had been replaced and to ascertain the current lead concentrations at these sites.

Since it was not feasible to examine all sites, approximately 10% of the designated residential replacement sites were randomly selected for verification sampling. This selection was made from a preliminary replacement site target list. Ninety-two sites were selected, sampled, and the soil or gravel analyzed. Three sites were removed from this group because the soil was not replaced due to either a refusal of replacement by the property owner, or because the site failed to qualify upon supplementary sampling (ie, the lead concentration was less than 500 ppm). A list of these sites was not available during the random selection and therefore they could not be excluded at that time.

4.2 Verification Sampling Methods

The verification sampling was conducted between the 14th and 19th of October, 1988. Three types of sample were collected. The first consisted of soil cores to a depth of five centimetres composited from at least 12 locations on the site. The second consisted of cores to a depth of 25 centimetres composited from at least six locations at a site. This depth was chosen to reduce the likelihood that the sampling did not penetrate into the underlying indigenous soil. The final sample type was a surface scraping, to approximately two centimetres, from gravel (car parking) areas. In all, 78 sites with replaced soil and 11 parking areas were sampled.

Samples were air dried in a laboratory and mechanically disaggregated to pass through a two millimetre mesh. A subsample of this less-than-two-millimetre material was then ground by a mortar and pestle until all material passed through a 335 micrometre mesh. This fine soil and powdered gravel material was subject to strong acid extraction. The acid extract was analyzed for lead.

The samples were collected, processed and analyzed by standard Phytotoxicology Section and Laboratory Services Branch methods. These methods were consistent with those used in all previous surveys.

4.3 Subsequent Sampling

A review of data from the October, 1988 sampling revealed a number of sites where the soil lead concentrations in the 0 to 25 centimetre increment was substantially higher than in the 0 to 5 centimetre increment. Whereas the 0 to 5 cm concentrations were typically less than 50 ppm, 13 of the sites had 0 to 25 centimetre increment concentrations ranging from 100 to 530 ppm.

There are a number of possible reasons for such high concentrations: 1) The site may have contained some obstruction, such as tree roots, which prevented removal of 30 centimetres of contaminated soil. 2) An inadequate amount of new soil may have been placed on the site. 3) The new soil may have become contaminated as a result of mixing with the underlying contaminated soil during the replacement process. 4) The sampling procedures may have inadvertently collected some indigenous, contaminated soil.

The last reason was a real possibility, since the replacement soil was very loose when it was sampled in October, 1988. The replacement procedures did not require mechanical compaction of the new soil. When the Oakfield™ soil corer was inserted to a depth of 25 cm, the length of the core obtained was frequently much less than 25 centimetres. The corer did not cut through 25 centimetres of soil, but compressed or displaced it. To obtain a full 25 cm-long core sample, the corer was frequently inserted to greater depths. The frequency of this compensatory procedure varied between sites and within a site.

It was recognized that altering the sampling procedure could result in the inclusion of underlying indigenous soil in the sample. Certain precautions were used to minimize indigenous soil collection, but there was no guarantee against it. Consequently, it was decided to re-examine or re-sample certain sites that were reported to have unusually high lead concentrations in the 0 to 25 centimetre increment.

Thirteen sites revealed apparent concentrations of 100 ppm or higher in the 0 to 25 centimetre increment. Three of these had large trees present, making it inappropriate to expect that 30 centimetres of soil could be removed and replaced. The remaining 10 sites were considered candidates for more detailed sampling.

Sampling of nine of these ten sites was conducted in May, 1991. The tenth site was not accessible since it was an enclosed back yard. The same sampling equipment was used, namely an Oak-fieldTM soil corer. Since the soil had an additional two and a half years to settle, the compaction difficulties encountered in 1988 were not present in 1991. Sampling of soil was conducted to produce three depth increments; 0-5, 5-15 and 15-25 centimetres. Eight cores were taken from each site, sectioned into the three measured increments, and the respective increments composited. All processing and analytical procedures were identical to those used in 1988.

5 Results

The attached table presents the results of the chemical analyses for lead on the samples collected at the 89 sites during the October, 1988 verification. The sites are grouped according to the five construction contracts, designated as Demo and Contracts 1, 2, 3 and 4. Arbitrary site numbers represent the 89 sites, and are followed by the street name and type and location of the site on the property. Soil lead concentration data are presented in two columns, one for the 0-5 cm and one for the 0-25 cm depths. A third column reports the lead concentrations in the 0-2 cm depth from gravel parking areas.

This table also contains three additional columns where data generated by the May, 1991 three-increment-depth sampling are presented. In one case, Site 1, the data listed for the May, 1991 samples are in fact the results for November, 1992 samples. The May, 1991 data for this site were determined to be invalid.

6 Discussion

6.1 Soil (0-5 cm) - October, 1988

The October, 1988 sampling revealed that 51 of the 78 replaced-soil sites had lead concentrations of less than or equal to 10 ppm in the top five centimetres. The laboratory qualified these lead concentration data as "measurable trace

amounts". Eighteen sites were reported to contain between 11 and 20 ppm lead. Eight sites had concentrations between 21 and 50 ppm. The remaining site had 64 ppm of lead in the top five centimetres.

There is heterogeneity in these concentrations, but the range is similar to the range reported for the replacement soil when it was sampled in its original location. Although this soil passed through various mechanical mixing procedures in the process of collection, screening, transportation and stockpiling, variability could persist due to the batch nature of these procedures.

6.2 Soil (0-25 cm) - October, 1988

In the 0-25 centimetre samples of replaced soil, 40 of 76 sites had concentrations of 20 ppm or less. At 23 sites, lead concentrations ranged between 25 and 99 ppm. The remaining 13 sites had concentrations of 100 ppm or more, with a maximum of 530 ppm.

As was discussed in Section 4.3, sampling to the 25 centimetre depth was technically difficult due to the uncompacted nature of the replacement soil. Consequently, a valid evaluation of the lead concentrations in the 0-25 cm increment, would have to be based on data generated by more detailed sampling.

6.3 Soil (Detailed Sampling) - May, 1991

As discussed in Section 4.3, nine sites were subjected to detailed sampling in May, 1991 (with one site repeat sampled in November, 1992). The range of lead concentrations in the 0-5 cm increment for eight of these was from 25 to 74 ppm. In these eight cases, the underlying, 5-15 cm increment had lead concentrations ranging from 13 to 27 ppm.

The concentrations of lead in the 15 to 25 cm increment at four of the sites was less than 100 ppm. Since the upper increments were also less than 100 ppm, it appears that the 1988 data, which reported concentrations greater than 100 ppm, was misleading. The sampling procedure probably penetrated the indigenous soil.

However, the remaining four sites sampled in 1991 (or 1992), revealed lead concentrations of 190, 530, 140 and 500 ppm in the

15 to 25 cm increment. This is highly indicative of the presence of indigenous soil at a depth greater than 15 centimetres, after there has been sufficient time for compaction.

While it is clear that some replaced sites do not have 30 cm of uncontaminated soil, it must be emphasized that at all eight of these sites, the soil in the top 15 centimetres had less than 100 ppm lead. Consequently, to ensure that the upper 15 centimetres of soil had relatively low lead concentrations, it was necessary to remove 30 centimetres and replace it with a like quantity of uncontaminated soil. This procedure ensured a barrier between the underlying contaminated soil, and interrupted the lead pathway between soil and neighbourhood residents and their children.

The May, 1991 (and November, 1992) sampling also provided a limited (eight site) data set for the concentrations of lead in the top five centimetres of soil which could be compared to the concentrations in this depth increment in October, 1988. Such a comparison suggests that the lead concentration in the top five centimetres of soil has increased since it was placed. The average in 1988 for these eight sites was 12 ppm. In 1991/92, it was 43 ppm.

To determine if these increases in lead concentrations were statistically significant, a two-tailed T-test was performed on log transformed data (distribution was not normal). The differences in the lead concentrations were highly significant ($p < 0.001$).

With data from only eight sites available, it is not possible to attribute this apparent re-contamination to any particular cause. These eight sites are distributed throughout the replacement zone and the magnitudes of increase in lead concentrations in the top five centimetres are similar at all of these sites. This is indicative of a phenomenon acting similarly throughout the replacement zone, not predominantly near CMC.

A determination of the cause for such an increase is beyond the scope of this report. However, since the 1991 5-15 cm concentrations are lower than those in the 0-5 cm increment, aerial deposition is the most likely cause. Possible sources of this lead include: emissions of lead from CMC, deposition of lead-bearing dust re-entrained from nearby surfaces not subjected to a clean-up, or simply deposition from the overall burden of lead in an urban atmosphere.

It should be noted that the Phytotoxicology Section is conducting a long-term soil lead re-contamination experiment in the South Riverdale area. This experiment is designed to monitor the influence of CMC on any changes in the concentration of lead in replacement soil. Also, the Phytotoxicology Section has conducted annual surveys to monitor lead concentrations in tree foliage around CMC, and will continue to respond to the Central Region's requests for assessments of the impact of CMC on the South Riverdale community.

One site of the nine sampled has not yet been discussed. At this site (No. 67), the lead concentrations in the three depth increments range from 270 to 450 ppm. Additional samples collected at this site in November, 1992 confirmed lead concentrations of this magnitude. This site was clearly altered after the replacement project. By May, 1991 this site had been transformed from a sodded lawn area into a landscaped flower bedding area containing paving bricks, pressure treated lumber and terraced flower beds.

6.4 Gravel Parking Areas - October, 1988

Unlike the soil samples from the lawn sites, the parking area samples were collected in a consistent manner. The results indicated that ten of the eleven sites sampled had concentrations ranging from 120 to 320 ppm. The one remaining site had a lead concentration of 25 ppm. Since the replacement gravel was not analyzed, it is not known whether the fine fraction contained high lead concentrations. However, this is unlikely.

A possible reason for elevated concentrations of lead in the replacement gravel has to do with the properties of the material and the manner in which it was sampled and processed. The material consisted of crushed stone up to 16 mm in size. Samples were taken by scraping the top two centimeters. The samples consisted of a mixture of coarse and fine material. Sample processing left a sample consisting of the less-than-two-millimetre fraction. This fraction was then powdered and submitted for analysis.

If the sample, as collected in the field, had been contaminated by fine material containing high concentrations of lead (eg., atmospherically deposited lead-containing dust), then the sample submitted for analysis, which contained a disproportionate amount of fine material, could be biased toward an elevated lead concentration.

Lacking information on the lead concentration of the bulk gravel, or data on lead concentrations in different size fractions of material at the car parking sites, it is not possible to determine with certainty the reason for elevated lead concentrations detected in the sampled gravel parking areas.

It does not, however, seem reasonable that the fine fraction of crushed limestone should contain as much as 320 ppm lead. Two possible explanations exist.

The first is that the fine fraction of the gravel was contaminated by fugitive emissions of contaminated soil or by airborne dust during or after the replacement process. In this scenario, lead contaminated dust, possibly from yet unreplaced sites, falls out onto the new gravel surface and is incorporated into the fine fraction. This fine fraction is the material submitted for analysis and is reported to contain much higher concentrations of lead than would a bulk sample of gravel stones and fine material.

The second explanation must be prefaced by noting that parking areas were replaced by removing 15 cm of indigenous material and replacing it with 15 cm of gravel that was subsequently compacted mechanically. It is possible that, during compaction, underlying material was forced up to the surface through the large pore spaces present in coarse gravel.

7 Conclusions

The Phytotoxicology Section verification sampling consisted of a random selection of approximately 10% of the replacement sites. This investigation confirmed that replacement was performed on qualifying sites. The top five centimetres of soil at replacement sites had concentrations of 64 ppm lead or less.

At the majority of sites, the depth of uncontaminated soil was 25 centimetres or more. At a few sites where this did not appear to be the case, supplementary sampling revealed soil with low lead concentrations to a depth of 15 centimetres.

This observation demonstrated the necessity of replacing 30 centimetres of soil to ensure at least a 15 centimetre layer of uncontaminated soil at the surface. Therefore, the soil replacement work conducted in 1987-88 met its objective of providing a barrier of uncontaminated soil.

The sampling of the top five centimetres of replacement soil over a 2.5 year interval revealed a trend to increased lead concentrations at the surface. The cause of this increase could not be determined in this investigation. However, other investigations currently underway, may provide some insight on this trend.

The fine fraction of gravel used in the replacement of car parking areas contained unexpectedly elevated concentrations of lead.

8 References

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9 Table

Lead Concentrations in Soil at South Riverdale
Replacement Sites

					Lead Concentrations (ppm)					
					October 1988			May 1991		
Contract Number	Site No.	Street	Site Type	Site Location	0-2 cm Gravel	0-5 cm Soil	0-25 cm Soil	0-5 cm Soil	5-15 cm Soil	15-25 cm Soil
Demo	1	Eastern	Lawn	Front		11	141	* 61	* 17	* 190
Demo	2	Leslie	Lawn	Front		22	230	74	19	530
Demo	3	Mosley	Lawn	Front		31	16			
Demo	4	Mosley	Lawn	Front		25	13			
1	5	Marigold	Lawn	Front		17	12			
1	6	Marigold	Lawn	Rear		11	100	25	20	140
1	7	Marigold	Parking	Rear	120					
2	8	Berkshire	Lawn	Rear		3	20			
2	9	Berkshire	Lawn	Front		8	17			
2	10	Berkshire	Lawn	Rear		7	17			
2	11	Berkshire	Lawn	Front		7	8			
2	12	Berkshire	Garden	Rear		9	250	30	14	14
2	13	Berkshire	Lawn	Front		6	tree			
2	14	Berkshire	Lawn	Front		9	tree			
2	15	Berkshire	Lawn	Front		6	9			
2	16	Hastings	Lawn	Front		8	10			
2	17	Laing	Lawn	Rear		11	10			
2	18	Laing	Lawn	Rear		11	12			
2	19	Leslie	Lawn	Front		9	18			
2	20	Queen	Lawn	Front		8	7			
2	21	Queen	Lawn	Front		19	9			
2	22	Queen	Lawn	Front		10	9			
2	23	Rushbrooke	Lawn	Side		13	10			

Lead Concentrations in Soil at South Riverdale
Replacement Sites (continued)

					Lead Concentrations (ppm)					
					October 1988			May 1991		
Contract Number	Site No.	Street	Site Type	Site Location	0-2 cm Gravel	0-5 cm Soil	0-25 cm Soil	0-5 cm Soil	5-15 cm Soil	15-25 cm Soil
2	24	Rushbrooke	Lawn	Rear		11	11			
2	25	Rushbrooke	Driveway		25					
2	26	Rushbrooke	Lawn	Rear		36	10			
2	27	Rushbrooke	Lawn	Front		12	7			
2	28	Rushbrooke	Lawn	Front		5	7			
2	29	Rushbrooke	Lawn	Front		7	7			
2	30	Rushbrooke	Lawn	Front		9	10			
2	31	Rushbrooke	Lawn	Front		7	7			
2	32	Rushbrooke	Lawn	Rear		8	6			
2	33	Rushbrooke	Lawn	Front		9	8			
3	34	Caroline	Lawn	Rear		6	25			
3	35	Caroline	Lawn	Rear		9	380	39	20	500
3	36	Caroline	Lawn	Rear		11	12			
3	37	Caroline	Parking	Rear	140					
3	38	Caroline	Lawn	Front		9	28			
3	39	Heward	Lawn	Front		11	16			
3	40	Heward	Lawn	Rear		6	8			
3	41	Larchmount	Lawn	Front		8	11			
3	42	Larchmount	Lawn	Front		10	8			
3	43	Larchmount	Parking	Rear	150					
3	44	Pape	Lawn	Rear		7	9			
3	45	Pape	Lawn	Front		7	260	37	26	23
3	46	Pape	Lawn	Rear		10	13			

Lead Concentrations in Soil at South Riverdale

Replacement Sites (continued)

					Lead Concentrations (ppm)					
					October 1988			May 1991		
Contract Number	Site No.	Street	Site Type	Site Location	0-2 cm Gravel	0-5 cm Soil	0-25 cm Soil	0-5 cm Soil	5-15 cm Soil	15-25 cm Soil
3	47	Pape	Lawn	Rear		7	7			
3	48	Pape	Lawn	Rear		48	13			
3	49	Pape	Parking	Front	160					
3	50	Pape	Lawn	Rear		64	55			
3	51	Winnifred	Lawn	Rear		8	370	property not accessible		
3	52	Winnifred	Lawn	Front		17	72			
3	53	Winnifred	Lawn	Front		11	58			
3	54	Winnifred	Lawn	Front		7	36			
3	55	Winnifred	Lawn	Front		10	12			
3	56	Winnifred	Lawn	Front		12	49			
3	57	Winnifred	Lawn	Front		9	55			
3	58	Winnifred	Driveway		120					
3	59	Winnifred	Lawn	Front		10	18			
4	60	Carlaw	Lawn	Front		7	30			
4	61	Carlaw	Lawn	Rear		7	9			
4	62	Carlaw	Parking	Rear	160					
4	63	Carlaw	Lawn	Rear		5	8			
4	64	Carlaw	Lawn	Front		10	180	30	27	24
4	65	Carlaw	Lawn	Front		9	12			
4	66	Carlaw	Lawn	Front		13	63			
4	67	Carlaw	Lawn	Front		41	340	** 270	** 450	** 300
4	68	Carlaw	Lawn	Front		7	12			
4	69	Carlaw	Parking	Front	280					

Lead Concentrations in Soil at South Riverdale

Replacement Sites (continued)

					Lead Concentrations (ppm)					
					October, 1988			May 1991		
Contract Number	Site No.	Street	Site Type	Site Location	0-2 cm Gravel	0-5 cm Soil	0-25 cm Soil	0-5 cm Soil	5-15 cm Soil	15-25 cm Soil
4	70	Carlaw	Lawn	Front		6	38			
4	71	Carlaw	Lawn	Rear		50	98			
4	72	Carlaw	Lawn	Rear		9	48			
4	73	Eastern	Lawn	Rear		8	91			
4	74	Eastern	Lawn	Rear		20	86			
4	75	Heward	Parking	Rear	270					
4	76	Heward	Lawn	Front		22	530	tree present		
4	77	Heward	Lawn	Rear		6	67			
4	78	Heward	Lawn	Rear		14	99			
4	79	Logan	Lawn	Rear		6	100	tree present		
4	80	Logan	Parking	Rear	320					
4	81	Logan	Lawn	Rear		7	79			
4	82	Logan	Lawn	Front		14	100	48	13	73
4	83	Morse	Lawn	Rear		6	78			
4	84	Morse	Lawn	Rear		9	34			
4	85	Morse	Lawn	Front		9	110	tree present		
4	86	Morse	Parking	Rear	260					
4	87	Morse	Lawn	Rear		9	65			
4	88	Morse	Lawn	Rear		9	56			
4	89	Morse	Lawn	Front		9	96			

* - data from November, 1992 samples

** - site altered, see Section 6.3



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